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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/758,815	01/16/2004	Yasuo Kitaoka	10873.1384US01	6582

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EXAMINER	
MCCALL SHEPARD, SONYA D	

ART UNIT	PAPER NUMBER
2813	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

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Office Action Summary	Application No.	Applicant(s)	
	10/758,815	KITAOKA ET AL.	
	Examiner	Art Unit	
	Sonya D. McCall-Shepard	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *23 May 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23,30 and 31* is/are pending in the application.

4a) Of the above claim(s) *24-29* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-23,30 and 31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 January 2004* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *19 December 2006*. 2/17/04, 4/18/06
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

Detailed Action

1. This office action is in response to application filed on 16 January 2004.

Elections/Restrictions

2. Applicant's election without traverse of Group II, claims 1-23, 30 and 31 in the reply filed on 23 May 2007 is acknowledged.

Claims 24-29 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made without traverse in the reply filed on 23 May 2007.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.

2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1-4, 30 and 31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagai et al. (US 2004/0016396) in view of Sarayama et al. (US 6,592,663).

With regard to claims 1 and 30, Nagai et al. teach in figure 1B and related text, a method of manufacturing a Group III nitride substrate comprising: forming a Group III nitride layer including gaps (103), on a substrate (101) and separating a part including the substrate and a part including the Group III nitride crystals from each other in vicinities of the gaps (note paragraph [0063]). Nagai et al. does not teach bringing a surface of the Group III nitride layer into contact with a melt containing alkali metal and at least one Group III element selected from gallium, aluminum and indium in an atmosphere containing nitrogen, to make at least one Group III element and the nitrogen react with each other to grow Group III nitride crystals on the Group III nitride layer. However, Sarayama et al. teach that it is known to bring a surface of the Group III nitride layer into contact with a melt containing alkali metal and at least one Group III element selected from gallium, aluminum and indium in an atmosphere containing nitrogen, to make at least one Group III element and the nitrogen react with each other to grow Group III nitride crystals on the Group III nitride layer as set forth at column 5, lines 45-66 and figures 3, 4A-4B. It would have been obvious to one having ordinary

skill in the art at the time the invention was made to use the process as taught by Sarayama et al. in the process of Nagai et al., since Sarayama et al. state at column 4, lines 5-15 that such a modification would produce a high quality GaN bulk crystal substrate using a process suitable for mass-production and furthermore, to fabricate an optical semiconductor device that produces an optical radiation of blue to ultraviolet wavelength with a large optical power.

With regard to claim 2, Nagai et al. teach the Group III element is gallium and the Group III nitride crystals are GaN crystals (note paragraph [0063]).

With regard to claims 3 and 31, Sarayama et al. teach an atmosphere containing nitrogen is a pressurized atmosphere (column 5, lines 34-36).

With regard to claim 4, Nagai et al. teach separation carried out using stress generated by a difference in coefficient of linear expansion between the substrate and the Group III nitride crystals (note paragraph [0026]).

6. Claim 5-14, 16-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagai et al. (US 2004/0016396) and Sarayama et al. (US 6,592,663) further in view of Kidoguchi et al. (US 2003/0143771) and Tezen (US 2003/0162340).

With regard to claim 5, Nagai et al. and Sarayama et al. teach the claimed invention but do not teach forming a semiconductor layer expressed by a composition formula of $Al_uGa_vIn_{1-u-v}N$ (wherein $0 \leq u \leq 1$ and $0 \leq v \leq 1$), on the substrate and forming convex portions by partially removing the first semiconductor layer; and

forming the Group III nitride layer having gaps in its portions other than the convex portions by growing a second semiconductor layer from upper surfaces of the convex portions of the first semiconductor layer, the second semiconductor layer being expressed by a composition formula of $Al_xGa_yIn_{1-x-y}N$ (wherein $0 \leq x \leq 1$ and $0 \leq y \leq 1$), wherein in the process the first semiconductor layer and the second semiconductor layer are separated from each other at the upper surfaces of the convex portions. However Kidoguchi et al. teach in figures 1 and 14 and related text a GaN based semiconductor laser diode formed from AlGaN layer (14A) grown from the top faces of the respective convexes (12a) of the seed layer (12) of GaN on a substrate (11) wherein the first semiconductor layer (12) and the second semiconductor layer (14A) are separated from each other at the upper surfaces of the convex portions (note paragraph [0218]). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the process as taught by Kidoguchi et al. in the process of Nagai et al. and Sarayama et al., since Kidoguchi et al. states in paragraph [0221] that such a modification would prevent leakage of generated light to the substrate in the semiconductor laser diode.

While Kidoguchi et al. teach AlGaN layer instead of $Al_uGa_vIn_{1-u-v}N$. Tezen shows that $Al_uGa_vIn_{1-u-v}N$ is an equivalent structure known in the art (note paragraph [0001]). Therefore because these two Group III nitride compound semiconductors were art recognized equivalents at the time the invention was made, one of ordinary skill in the art would have found it obvious to substitute $Al_uGa_vIn_{1-u-v}N$ for AlGaN.

With regard to claim 6, Kidoguchi et al. teach an upper C-plane surface (note abstract).

With regard to claim 7, Kidoguchi et al. teach a method wherein the convex portions are formed in stripes (note paragraph [0127]).

With regard to claim 8, Kidoguchi et al. teach a method wherein the concave portions that are portions other than the upper surfaces of the convex portions are covered with a mask film (note paragraph [0272]).

With regard to claim 9, Kidoguchi et al. teach a method wherein the mask film contains at least one selected from a group consisting of silicon nitride, oxide silicon, nitride oxide silicon, aluminum oxide, aluminum nitride oxide, titanium oxide, zirconium oxide and niobium oxide (note paragraph [0273]).

With regard to claim 10, Kidoguchi et al. teach a method wherein the mask film is made of high melting metal or a high melting metallized material (note paragraph [0273]).

With regard to claim 11, Kidoguchi et al. teach a method wherein the mask film contains at least one selected from a group consisting of tungsten, molybdenum, niobium, tungsten silicide, molybdenum silicide and niobium silicide (note paragraph [0273]).

With regard to claim 12, Kidoguchi et al. teach forming convex portions by processing a surface of a substrate and growing a Group III nitride layer from upper surfaces of the convex portions to form a seed crystal substrate having gaps formed

between the substrate and the Group III nitride layer (figures 1, 14 and paragraph [0218]). Sarayama et al. teach bringing a surface of the Group III nitride layer into contact with a melt containing alkali metal and at least one Group III element selected from gallium, aluminum and indium in a pressurized atmosphere containing nitrogen, to make at least one Group III element and the nitrogen react with each other to grow Group III nitride crystals on the Group III nitride layer as set forth at column 5, lines 45-66 and figures 3, 4A-4B and Nagai teach separating a part including the substrate and a part including the Group III nitride crystals from each other in vicinities of the gaps (note paragraph [0063]).

With regard to claim 13, Kidoguchi et al. teach a sapphire substrate (11) (note paragraph [0127]).

With regard to claim 14, Sarayama teaches wherein the alkali metal is at least one selected from sodium, lithium and potassium (figures 4A and 4B).

With regard to claim 16, Kidoguchi et al. teach forming a first semiconductor layer expressed by a composition formula of GaN (12a) equivalent to $Al_uGa_vIn_{1-u-v}N$ (wherein $0 \leq u \leq 1$ and $0 \leq v \leq 1$), on the substrate (11); and forming concave portions to be gaps by partially removing the first semiconductor layer to expose portions of the substrate and thereby forming remaining portions into convex portions, wherein Group III nitride crystals (14A) are grown on the surfaces of the convex portions formed in the process (figures 1 and 14 and paragraph [0218]).

With regard to claim 17, Kidoguchi et al. teach forming a mask film (13) patterned on the substrate and forming a first semiconductor layer with a convex shape on each of portions of the substrate that are not covered with the mask film to allow concave portions to be gaps, the first semiconductor layer being expressed by a composition formula of GaN (12a) equivalent to $Al_uGa_vIn_{1-u-v}N$ (wherein $0 \leq u \leq 1$ and $0 \leq v \leq 1$), and the concave portions being portions where the first semiconductor layer with the convex shape has not been formed, wherein the Group III nitride crystals are grown on a surface of the first semiconductor layer formed in the process (figures 1, 14 and paragraph [0218]).

With regard to claim 18, Kidoguchi et al. teach the claimed process wherein the group III nitride layer including gaps includes a semiconductor layer expressed by a composition formula $Al_xGa_yIn_{1-x-y}N$ (wherein $0 \leq x \leq 1$ and $0 \leq y \leq 1$), and after forming the semiconductor layer, the gaps are formed in the semiconductor layer or at the surface of the semiconductor layer through a temperature programmed heat treatment carried out in an atmosphere of a mixture of ammonia and nitrogen (note paragraphs [0140] and [0141]).

With regard to claim 19, Tezen teaches the Group III nitride layer including gaps is a semiconductor layer expressed by a composition formula of $Ga_xIn_{1-x}N$ (wherein $0 \leq x \leq 1$) (note paragraph [0001]).

With regard to claim 20, Kidoguchi et al. do not explicitly teach a temperature programmed heat treatment carried out at a programming rate of 50 to 100°C/min.

Nonetheless, the choice of temperature is considered an obvious optimization to one of ordinary skill in the art at the time of the invention. The ranges claimed do not achieve any unexpected results over the prior art and are considered obvious. In re Aller, 105 USPQ 233. (CCPA 1955).

7. Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nagai et al. (US 2004/0016396) and Sarayama et al. (US 6,592,663) in view of D'Evelyn et al. (US 2004/0124434).

With regard to claim 15, Nagai et al. and Sarayama et al. teach the claimed invention but do not teach the method wherein the melt further contains alkaline earth metal. However, D'Evelyn et al. teach that it is known to use a method wherein the melt comprises alkali and alkaline-earth nitrides. It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the process as taught by D'Evelyn et al. in the process of Nagai et al. and Sarayama et al., since D'Evelyn et al. state in paragraphs [0030] and [0031] that such a modification in the methodology is preferred because of easier process control and higher quality crystals.

8. Claims 21-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nagai et al. (US 2004/0016396) and Sarayama et al. (US 6,592,663) in view of Takeya et al. (US 2005/0000407).

With regard to claim 21, Nagai et al. and Sarayama et al. teach the claimed invention but do not teach the method wherein a cycle of gaps is at least 30 μm. However, Takeya et al. teach that it is known to use a method wherein the d_1 between convexes is 9 μm or more or preferably 10 μm or more (figure 2 and paragraph [0061]). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use the process as taught by Takeya et al. in the process of Nagai et al. and Sarayama et al., since Takeya et al. state that such a modification in the process would improve the crystallinity of the semiconductor layer.

With regard to claim 22, Takeya et al. teach that it is known to use a method wherein the d_1 between convexes is 9 μm or more or preferably 10 μm or more (figure 2 and paragraph [0061]).

With regard to claim 23, Takeya et al. teach that it is known to use a method wherein the d_1 between convexes is 9 μm or more or preferably 10 μm or more (figure 2 and paragraph [0061]).

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sonya D. McCall-Shepard whose telephone number is 571-272-9801. The examiner can normally be reached on Monday to Friday from 7:30 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached on 571-272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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